

Patent
Serial No. 09/837,936
Amendment in Reply to Office Action of August 8, 2005

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently amended) A method for estimating a bottleneck bandwidth used to support estimation of the bottleneck bandwidth between a server and a client in a communication system, the method comprising the steps of:

receiving at said client a plurality of bursts comprised of at least 3 packets transmitted from said server via a bottleneck link of said system;

computing a set of bandwidth samples from each of said bursts received by said client, wherein said bandwidth samples are computed based on ~~a difference between an~~ inter-packet spacing between ~~the~~ a first and ~~the~~ a last packet within each of said bursts;

filtering out bandwidth samples from said set of bandwidth samples based on at least one characteristic of said received bursts, selected ones of said bandwidth samples; and

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determining a new bottleneck bandwidth from said unfiltered computed bandwidth samples, for transmission of subsequent data packets from said server to said client.

2. (Currently amended) The method of claim 1, comprising maintaining a bandwidth sample lifetime, wherein the step of filtering comprises the step of:

~~rejecting filtering~~ bandwidth samples having that have a
sample life time greater than a threshold bandwidth lifetime.

3. (Currently amended) The method of claim 1, wherein the step of filtering comprises the step of:

~~rejecting filtering~~ bandwidth samples encountering an
operating system (OS) delay of said client system.

4. (Original) The method of claim 3, wherein the bandwidth samples encountering said OS delay is determined based on a quantity difference between an ideal burst duration prior to encountering said OS delay and an actual burst duration after encountering said OS delay.

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5. (Currently amended) The method of claim 1, ~~wherein the step of filtering comprises comprising the step of:~~ determining to reject a set of bandwidth samples by

rejecting bandwidth samples having a retransmitted packet.

6. (Previously presented) The method of claim 1, wherein the plurality of said packet bursts is transmitted at a maximum speed by said server system so that the inter-packet spacing is introduced in each of said bursts.

7. (Original) The method of claim 1, wherein said new bandwidth corresponds to a median value of said computed bandwidth samples for a low speed link.

8. (Original) The method of claim 1, wherein said new bandwidth corresponds to the statistical mode of said computed bandwidth samples for a high speed link.

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9. (Previously presented) The method of claim 1, wherein said new bandwidth corresponds to a minimum bandwidth of said computed bandwidth samples if a multi-channel link is deployed between said server and said client.

10. (Currently amended) The method of claim 1, ~~wherein the step of filtering comprises~~ comprising the step of+ determining to reject a set of bandwidth samples by

~~eliminating rejecting~~ bandwidth samples having a missing packet within a corresponding one of said bursts.

11. (Cancelled)

12. (Currently amended) A method for estimating a bottleneck bandwidth used to support congestion control between a server and a client, the method comprising the steps of:

~~(a) transmitting~~ by said server through a bottleneck link a plurality of ~~burst~~ bursts comprised of at least 3 packets to said client at a maximum rate;

~~(b) computing~~ by said client a set of bandwidth samples for

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each of said burst packet, said bottleneck bandwidth being a difference ~~between an~~ inter-packet spacing between ~~the a~~ first and ~~the a~~ last packet within each of said bursts;

~~(c)~~ filtering out selected bandwidth samples from said computed bandwidth samples, wherein the selection is made according to predetermined criteria; and,

~~(d)~~ determining a new bottleneck bandwidth for the following transmission of data packets between said server and said client,

wherein determination of said new bottleneck bandwidth is based on said computed bandwidth samples and said filtering step.

13. (Currently amended) The method of claim 12, wherein the step of computing said bandwidth samples comprises the steps of:

determining the start time and the end time of the reception of the first and the last packet within each of said bursts;

determining the packet size of the second packet and the last packet for each of said bursts; and,

computing said bandwidth samples based on a difference between the packet size of the second packet and the last packet, divided

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by a ~~difference between an~~ inter-packet spacing duration between the first and the last packet within each of said bursts.

14. (Previously presented) The method of claim 12, wherein the plurality of said packet bursts is transmitted at a maximum rate by said server system so that the inter-packet spacing is introduced in each of said bursts.

15. (Currently amended) The method of claim 12, wherein the step of filtering said computed bandwidth samples comprises the step of:

~~rejecting~~ filtering bandwidth samples having a sample life time greater than a threshold bandwidth lifetime.

16. (Currently amended) The method of claim 12, wherein the step of filtering said computed bandwidth samples comprises the step of:

~~rejecting~~ filtering bandwidth samples encountering an operating system (OS) delay of said client system.

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17. (Original) The method of claim 16, wherein the bandwidth samples encountering said OS delay is determined based on a quantity difference between an ideal burst duration prior to encountering said OS delay and an actual burst duration after encountering said OS delay.

18. (Currently amended) The method of claim 12, ~~wherein the~~
~~comprising the step of filtering-determining to reject a set of~~
~~bandwidth samples from said computed bandwidth samples comprises~~
~~the step of:~~

~~-by~~ rejecting bandwidth samples having a retransmitted packet.

19. (Original) The method of claim 12, wherein said new bandwidth corresponds to a median value of said computed bandwidth samples for a low speed link.

20. (Original) The method of claim 12, wherein said new bandwidth corresponds to the statistical mode of said computed bandwidth samples for a high speed link.

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21. (Previously presented) The method of claim 12, wherein said new bandwidth corresponds to a minimum bandwidth of said computed bandwidth samples if a multi-channel link is deployed between said server and said client.

22. (Currently amended) The method of claim 12, further comprising the step of:

~~eliminating~~ determining to reject a set of bandwidth samples
by rejecting bandwidth samples having a missing packet within each
of said bursts a corresponding burst.

23. (Currently amended) A device for estimating a bottleneck bandwidth used to support congestion control between a server and a client, the method comprising the steps of:

means for transmitting plurality of bursts comprised of at least 3 packets;

means for receiving said burst packets via a bottleneck link;

means for generating a set of bandwidth samples based on a ~~difference between an inter-packet spacing between the~~ a first and ~~the~~ a last packet within each of said bursts;

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means for filtering based on at least one predetermined criterion said generated bandwidth samples to eliminate selected ones of said bandwidth samples from said generated bandwidth samples; and,

means for determining a new bottleneck bandwidth from said generated bandwidth samples for transmission of subsequent data packets between said server and said client.

24. (Currently amended) The device of claim 23, comprising means for maintaining a threshold bandwidth lifetime of said bursts, wherein said means for filtering criterion comprises: a said threshold bandwidth lifetime.

25. (Currently amended) The device of claim 23, wherein said means for filtering criterion comprises: an operating system (OS) delay of said client.

26. (Currently amended) The device of claim 23, ~~wherein said comprising a means for filtering criterion determining to reject said set of bandwidth samples comprises: by rejecting~~

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bandwidth samples having a retransmitted packet.

27. (Currently amended) The device of claim 23, ~~wherein said~~
comprising a means for filtering criterion determining to reject
said set of bandwidth samples comprises— rejecting bandwidth
samples having a missing packet.